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ABSTRACT

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AN ANALYSIS OF THE SELECTION CRITERIA FOR THE EIGHTH GRADE ALGEBRA I ACCELERATED MATHEMATICS PROGRAM IN HARRISON COUNTY, WEST VIRGINIA

A Thesis

Presented to

The Faculty of the Master of Arts Degree Program

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Master of Arts in Education

By

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Salem-Teikyo University
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This thesis submitted by Jonette Schrecongost has been approved meeting the research requirements for the Master of Arts Degree.

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This study analyzed the criteria used in Harrison County, WV, to select students to participate in an accelerated mathematics program. The program's main component is an eighth grade Algebra I course that enables the students to complete five years of college preparatory mathematics, ending with calculus. The scores used as selection criteria, CTBS concepts, CTBS computation, and pre-algebra grades, were all found to be good predictors of success. The results indicate, however that the current standards need to be raised. Requiring higher scores would eliminate a significant number of program dropouts (currently 51%). A fourth selection criteria, a 65th percentile on the Iowa Algebra Aptitude Test, could not be evaluated since there was no record of such test results. However, other studies indicate that both an algebra prognosis test and an assessment of interest would be helpful.

An Analysis of the Selection Criteria for the Eighth Grade Algebra I Accelerated Mathematics Program in Harrison County, West Virginia

CHAPTER ONE

Introduction

In 1979, the Harrison County Board of Education adopted a program for the acceleration of some eighth grade students by placing them in an Algebra I class. The main purpose of this program is to provide students with the opportunity to take five years of college preparatory mathematics without having to take two mathematics classes simultaneously.

Some students do well and complete the five-year program. Some do not. There are some students who drop out during the first year, some who must repeat Algebra I, some who continue, though with considerably lower grades than they were accustomed to earning, and some who quit after only three years of mathematics.

Of course not all students are offered this opportunity. Only those who satisfy the board approved selection criteria are to be placed in the eighth grade Algebra I classes. These students are required at that time to also sign an agreement that they will continue through five years of high school mathematics. Since many students cannot or will not fulfill their agreement to complete the program, a question is raised as to the effectiveness of the selection criteria.

This study proposes to assess whether the criteria used in Harrison County to place students in the eighth grade Algebra I program are effective in identifying students who will be successful in meeting the goals of the program. These goals are not only to be successful in Algebra I (grade A or B), but to maintain a high grade average while completing five years of college preparatory mathematics. The criteria used are listed below. A copy of the agreement each student must sign is contained in Appendix A.

The research question, therefore, is: "Do the current criteria for entering Algebra I in the eighth grade serve as good predictors of success in completing the Accelerated Mathematics Program in Harrison County?"

MATHEMATICS

Eighth Grade Algebra and Accelerated Seventh Grade Math

To be enrolled in an Algebra I class as an eighth grade student, the student must meet four of the five following criteria:

1. A score in the 65th percentile or higher on the Iowa Algebra Aptitude Test;
2. A score in the 75th percentile or higher on the Math Concepts Subtest of the Comprehensive Tests of Basic Skills as a seventh grade student;
3. A score in the 80th percentile or higher on the Computation Subtest of the Comprehensive Tests of Basic Skills as a seventh grade student;
4. At least a "B" average in the seventh grade math class;
5. The recommendation of the teacher from the seventh grade math class.

Students who enroll in Algebra I as eighth graders should have been enrolled in an accelerated mathematics class as seventh graders. The curriculum of the accelerated class should consist of those skills from both seventh and eighth grade math classes which are necessary for success in Algebra I.

Students who have a "B" average or higher in an eighth grade Algebra I class may enroll in geometry as a ninth grade student.

To enroll in an accelerated seventh grade math class, students must meet four of the five following criteria:

1. A score in the 70th percentile or higher on the Math Concepts Subtest of the Comprehensive Tests of Basic Skills as a sixth grade student;
2. A score in the 70th percentile or higher on the Math Applications Subtest of the Comprehensive Tests of Basic Skills as a sixth grade student;
3. A score in the 70th percentile or higher on the Math Computations Subtest of the Comprehensive Tests of Basic Skills as a sixth grade student;
4. At least a "B" average in the sixth grade math class;
5. The recommendation of the teacher from the sixth grade math class.

File IDAM, Harrison County Board of Education Policy Manual, Adopted: July 20, 1982

Limitations

This study will not attempt to determine new criteria for placement into the accelerated mathematics program, nor will it attempt to determine why the current criteria are or are not good predictors.

This study will be limited to participating students throughout Harrison County from the class of 1998. These students will be selected from each high school where the principal has granted access to records. Age, gender, and socioeconomic background of the students will not be considered.

Assumptions

1. The accelerated mathematics program will continue in Harrison County.
2. The changes in the high school mathematics curriculum recently suggested by the West Virginia State Board of Education do not affect the placement of students in the accelerated mathematics program in Harrison County.
3. Participants in the program from the class of 1998 are representative of all Harrison County participants.
4. The 149 participants in the program from the class of 1998 form a sample of adequate size.

Definitions

Success in the eighth grade Algebra I class is defined, according to the board approved requirements, as completing the course with an A or B grade average.

Success in the accelerated mathematics program is defined, according to the board-approved requirements, as completing each of the five college preparatory courses with an A or B grade average.

AMP is defined as the Accelerated Mathematics Program in Harrison County.

Research Questions

Research question 1: Does a student's score on the CTBS mathematics concepts subtest predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the CTBS mathematics concepts subtest.

H_1: There is a significant relationship between success in the AMP and the CTBS mathematics concepts subtest.

Research question 2: Does a student's score on the CTBS mathematics computation subtest predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the CTBS mathematics computation subtest.

H_2: There is a significant relationship between success in the AMP and the CTBS mathematics computation subtest.

Research question 3: Does the average of a student's scores on the CTBS computation and mathematics concepts subtests predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the average of the scores on the CTBS computation and mathematics concepts subtests.

H_3: There is a significant relationship between success in the AMP and the average of the scores on the CTBS computation and mathematics concepts subtests.

Research question 4: Does a student's score on the Iowa Algebra Aptitude Test predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the Iowa Algebra Aptitude Test.

H_4: There is a significant relationship between success in the AMP and the Iowa Algebra Aptitude Test.

Research question 5: Does the student's grade in seventh grade pre-algebra predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and final grade in seventh grade pre-algebra.

H_5: There is a significant relationship between success in the AMP and final grade in seventh grade pre-algebra.

Importance of This Study

A study of the effectiveness of the current criteria for placement in the accelerated mathematics program has not been done in Harrison County in the 18 years of its existence. This program affects approximately thirty percent of Harrison County students. Though the program is intended to help students with above average math ability, it has the potential to hinder the success not only of the mathematically talented, but also of those who are misplaced in the program.

Information about the effectiveness of the current criteria could lead to the creation of new criteria that would more accurately predict success. It could also lead to the elimination of non-predictive criteria. This could save time and effort for the teachers and counselors involved in the selection process.

CHAPTER TWO

Review of Literature

History

Throughout the history of mathematics education in America, what mathematics topics were taught, and how and when they were taught have been dependent on the apparent prevalent use of mathematics of the time. Only over the previous century did algebra and geometry move from the college curriculum into the high school curriculum. Until 1876 no math beyond calculus was taught even at the college level. Now calculus is available in most high schools.

The earliest texts encountered illustrated the rule method, the foremost means of teaching arithmetic in colonial times. It was suggested that, because of the difficulty level, arithmetic should not be studied before age 11 (Bidwell, 1970).

A concern for pedagogy in arithmetic teaching began in the 1820s with Warren Colburn's first arithmetic text in which he began a formalization of the mental discipline theme. In an address before the American Institute of Instruction, in 1830, Colburn advocated the newer methods of teaching arithmetic. Into the mid 19th Century, arithmetic was increasingly formalized into a logical system of definitions, principles and theorems. An extended use of manipulatives in early work also became widespread at this time.

Around the turn of the century, national and international organizations began to study math curriculum and to recommend reforms. The National Education Association's Committee of Ten on Secondary School Studies, dominated by college professors and school administrators, recommended the introduction of concrete geometry and algebra into the arithmetic program. The main concern at this time was the utility of mathematics. Reformers moved toward practicality. There was a strong trend toward integrating math and science and the use of the laboratory method (Bidwell, 1970).

The American Report of the International Commission on the Teaching of Mathematics in 1911 gave a variety of reasons for introducing algebra in the eighth grade and for removing it from the eighth grade. Some felt that the introduction would be motivational and encourage students to continue on to high school in order to study more math. Others felt it was necessary to bridge the gap between arithmetic and algebra. Another group felt it was helpful to the students in solving some of the more difficult arithmetic problems.

The prevalent tendency at that time to highly regard those subjects of practical value, combined with the public's general opinion that algebra had no practical value, led to some schools dropping algebra topics from the eighth grade arithmetic course. Efforts in some systems were made to include only enough algebra to familiarize the students with literal notation and the equation. This was deemed all that was practical of algebra for ordinary purposes. It was recognized that mechanics and others who read trade journals would realize its utilitarian value (Bidwell, 1970).

In 1923 the Mathematical Association of America (MAA) published a report titled The Reorganization of Mathematics in Secondary Education. It recommended that throughout seventh, eighth, and ninth grade arithmetic, intuitive geometry and algebra should be taught as an integrated unit. This would give the students a grasp of the important interrelations between these areas before studying each as a separate subject. Considering the large number of students at that time who dropped out of school after eighth or ninth grade, this approach offered the advantage of a broader view of elementary mathematics over the old approach.

The Depression and subsequent lack of employment opportunities resulted in more students staying in high school and fewer going to college. Math was not popular.

Emphasis was placed on meeting needs and social requirements which led to the teaching of mathematical material only if it was needed in a non-mathematical situation. This was referred to as "incidental teaching" (Bidwell, 1970).

In 1940 a Joint Commission of the MAA and the National Council of Teachers of Mathematics (NCTM) produced a report on the Place of Mathematics in Secondary Education. In an effort to popularize mathematics, the goals of mathematics and the role of individual student differences were stressed. The study of mathematics was advocated because it developed clear thinking, because formulas were necessary in modern society, and because mathematics was part of one's cultural background.

During World War II the need for trained manpower developed and the need to defend mathematics no longer existed. By 1945, the NCTM was again stressing functional competence for everyone, suggesting a track program. The teaching of math as a tool subject was abandoned as was the incidental teaching of math. This report was much more in keeping with the 1923 report than those of the 1930s (Bidwell, 1970).

Skilled, college trained manpower was needed and the face of mathematics research was changing, making the high school college preparatory program inadequate and out of touch. One result was the 1951 establishment, under the direction of Max Beberman, of the University of Illinois Committee on School Math (UICSM), referred to as "the progenitor of all current curriculum projects in mathematics" (Henderson, 1963).

In the Mathematics Teacher of October, 1951, G. B. Price pushed for special education for the gifted student. He argued that their education would be a failure if only the usefulness of math was stressed without sufficient attention to the beauty and structure of mathematics. The Mathematics Teacher of May, 1954 was devoted to the problems in the high school mathematics curriculum and proposals for reform. These concerns for the high school mathematics program and the 1955 appointment by the College Entrance Examination Board (CEEB) of a special commission to study mathematical needs of American youth antedate the Sputnik excitement. Although the

Soviet achievements did not cause reform, they did serve to increase public awareness and acceptance of the need for reform, resulting in higher standards for both mathematics and science (Jones, 1970).

The CEEB appointed Commission on Mathematics had a great influence on teacher training, textbooks, and curriculum. Although it left other tracks unrevised, the report greatly affected the college preparatory program. This commission also was the first to recommend the Advanced Placement Program, through which a high school student could receive a college level course in calculus and analytical geometry.

All college-capable students were advised to take four years of college preparatory mathematics, and certainly not less than three years. For the most gifted students, acceleration of math was recommended so as to allow time for a fifth course of math, most likely in the Advanced Placement Program.

Since the late 1950's, whether there was emphasis elsewhere on the new math, back to basics, or new NCTM standards, the accelerated program placing capable eighth graders in an Algebra I course has remained popular (Bidwell, 1970).

Although mathematics education has changed drastically since colonial times when arithmetic lessons were not begun until age 11, the basic issues of selecting and sequencing content and choosing when to teach it are still researched and debated. These areas of research hold the greatest promise for influencing educational practices (Shumway, 1980).

Over the history of the country, what to teach, content and sequencing, has been greatly influenced by social attitudes and perceived needs. The general approach to mathematics has bounced back and forth between formalization and practicality. Accordingly, there is a current trend toward practicality. Although no one is pushing for the incidental teaching of mathematics again, business and industry are exerting influence on public education to include more application-oriented mathematics as well as more cooperative learning methods.

Other Studies

In 1983 a study was undertaken by Ann S. Reynolds in Piedmont, California, to analyze and propose the best criteria for identification of mathematically talented sixth graders in an upper middle income community. Although a great amount of importance was placed on individual testing to determine IQ and specific types of thinking skills and creativity, the CTBS math subtests were found to be a more valid predictor of success than either scholastic aptitude tests or the California Short-form Test of Mental Maturity.

Previously given tests, teacher, parent and peer nominations and fifth and sixth grade marks were used to create a pool of candidates who were then tested individually. Special aptitude tests were administered for program selection. The Orleans-Hanna Algebra Prognosis Test was found to be effective in predicting readiness and success in Algebra I.

It was found through this study that it is important to assess student interest, as schools that did not had a much higher rate of attrition. Ability alone is not a reason for acceleration or specialization, it is only for those interested. The study was done by examining the correlation between the various selection criteria, age, and gender and the students' success and continuance in the program. It was interesting to note that, though no cut off scores were listed in the study, only three out of the fifty-three students involved had total math scores of less than 90 on their basic skills test.

Another study, done by Barbara Flexer, 1984, was designed to investigate the relative value of selected cognitive variables for predicting success as measured by Algebra grades and scores on a standardized first year algebra test. The four predictors used were student IQ's, percentage grades for seventh grade mathematics, math achievement scores, and prognosis for success as measured by the Orleans-Hanna Algebra Prognosis Test.

Although the IQ test was not significantly correlated with the algebra grade, the other three predictors were. Only grades from seventh grade math were not significantly correlated with student performance on the algebra achievement test. The algebra prognosis test was identified as the best overall predictor of success in the eighth grade algebra course.

Flexer points out that a study of this type is the first step towards reducing the incidence of the trauma of failure experienced by previously high-achieving students.

A study of the effectiveness of the Bryan Independent School District's (BISD) accelerated math program was made by Clarence Dockweiler of Texas A & M University (1981). BISD used an identification matrix including previous math grades, teacher evaluations, IQ, math scores from the CTBS, PSAT, and the Iowa Algebra Aptitude Test.

Although cut offs for each test were not given in the study, there were some interesting results. Each of the individual factors and the matrix total were correlated with the students Algebra I grade. A linear regression was also used to help determine the best factor combination to predict success. The analysis suggested that the teacher evaluation, IQ, and Iowa Algebra Aptitude score did not contribute to the model's predictive success enough to warrant their inclusion. It also suggested that some math grades and math achievement scores would be adequate. However, the dropout rate was a problem. The overall dropout rate averaged 57% by the fifth year course.

Though the selection criteria were apparently more complex than necessary, the statistics show that they were good predictors of success for the first year only, and not good at predicting continuance in the program.

Readiness

When to teach any particular content is an issue of readiness. Instruction needs to match the child's level of cognitive development rather than to simply fit the child into the appropriate step in a sequence of instruction (Shumway, 1980). In addition, the student must be placed in situations where s/he will take the exploratory step to do some reasoning. It is important that this step is an effective length and not so large as to make it too difficult (Epstein, 1981).

Michael Thayer and Patricia Arline have succeeded in constructing and validating a test to determine a child's cognitive level. Its predictive capacity correlated strongly with student performance in various subjects. Test data for 3,000 students showed that five cognitive levels reflected brain growth stages. Although at any one age children are not equivalent in their reasoning skills, it can be shown that brain growth plateaus exist during which time the cognitive level remains constant. The idea of matching these cognitive levels, recognizing the plateaus, and adjusting curriculum materials appropriately may have a great impact on all of teaching .

Identifying and matching individual cognitive levels may be beyond the reasonable expectations of the public educational setting. However, it should be possible to identify clusters of children who exhibit similar profiles of performance (Shumway, 1980).

Identifying clusters of students who are ready to begin their formal study of algebra becomes the first issue to consider for an accelerated math program. Accurate identification of participants for these programs is one of the most important ingredients for providing an appropriate education.

Likening the study of algebra to the study of language, which has been shown to be more easily learned at a younger age, Zalman Usiskin supports the idea that algebra should also be started much earlier. Most other reports follow Piaget's theory of cognitive development and agree that it requires formal abstract thinking skills (Prevost, 1988). In a study by Joyce Bishop seventh and eighth grade students' thinking about mathematical patterns was explored. It was found that working with patterns and using symbols as representations of them promote algebraic reasoning. This would be helpful in the intermediate grades and in enrichment classes (Bishop, 1997).

A child may excel at computation and even use this to solve difficult problems without understanding the underlying concepts. This child is not ready to study algebra. Before studying algebra a child needs a firm foundation in general mathematics, the structure of the number system, arithmetic problem solving, and formal operational thinking skills (Stanley, 1990).

Abstract reasoning skills, the ability to consider the possible rather than being restricted to concrete reality, to use complex classification strategies, and to readily shift the basis of classification are needed for any real success in high school mathematics. In general, the capabilities for formal operational thought appear to be necessary for success in most mathematics beyond basic arithmetic. The learning of heuristic strategies certainly appears to depend on formal reasoning processes, an area in which many high school students have little success (Shumway, 1980).

Since its beginning in 1971, the Johns Hopkins University Search for Mathematically Precocious Youth (SMPY) program has strongly advocated acceleration for extremely talented youth. SMPY is looking for students who score in the top three percentiles on an in-grade normed testing instrument and have reasoning abilities comparable to those of a student five years their senior. Seventh graders, for example, were chosen for the program who had reasoning abilities equivalent to or greater than that of college bound seniors (Corazza, 1995). SMPY warns against rushing ahead into fairly abstract mathematics. Although acceleration may be best for the extremely mathematically talented, even these students should not race through the standard courses in shorter time. They would benefit from both a more in depth study of each topic and working with mentors, clubs, competitions, and summer programs to provide necessary stimulation (Stanley, 1990).

Even Usiskin, who proposes that algebra can, should, and must be taught in the eighth grade, is concerned about readiness. He proposes major changes in the teaching of mathematics in the primary and middle grades and a strong precursor to Algebra I in order to have 40% of eighth graders ready to take algebra. The Third International Mathematics and Science Study found the United States to be the only country whose students dropped from above the international average in the fourth grade to below that average in the eighth grade. The study went on to suggest that the United States schools need to provide more advanced mathematics in this time period (Department of Education, 1997). Usiskin also proposes an altered course content for the Algebra I course that eliminates some of the currently accepted instructional goals (Usiskin, 1976).

With the strong need to assess readiness, a test like that developed by Thayer and Arlin could be very useful. Currently, the Harrison County School Board, along with most of those districts in the studies cited, use some sort of algebra readiness test, such as the Iowa Algebra Aptitude Test or the Orleans-Hanna Algebra Prognosis test.

Prerequisite knowledge is also of great importance and plays a major role in concept and principle learning. Attainment of competency in the skills prerequisite to the study of algebra therefore needs to be assessed. This is a simple process of having the student demonstrate that (s)he can perform the skills required. In studying skill learning at various levels, an important conclusion was children with a low degree of proficiency on subskills made little improvement while working on a more complex skill. Thus it is important that students are able to exhibit competency of pre-algebra skills before embarking on the more complex mathematics of algebra (Shumway, 1980).

Testing students for competency in pre-algebra skills is generally done by using some form of standardized basic skills test. The providers of basic skills tests such as the Comprehensive Test of Basic Skills and the Stanford Achievement Tests make great efforts to assure that their tests are standardized and can be used effectively throughout the nation. Much information about the tests is provided so that appropriate levels of the test can be chosen for use with each grade level. The CTBS, for example, has eleven overlapping levels. Use of the higher level of the appropriate choices allows for a more accurate picture of the talented student's achievement (Bassett, 1990).

As mentioned previously, lower level skills are not improved upon by attempting to learn more complex skills. Therefore, a student who has not mastered the basic pre-algebra skills is not likely to enhance these skills in an algebra course. Even if the student meets the minimum requirements to pass the Algebra I course, (s)he will likely have little chance of real success in higher math courses.

Common Problems

Two problems encountered in the eighth grade Algebra I programs are overplacement and the dropout rate. When children are confronted with work for which they are not yet ready, they often fall behind academically and some never make up the lost ground (Johnson 52). Often parents push for acceleration. Many teachers and principals who are harassed by anxious parents, or who want to look good in the public eye, push children into advanced work before they are ready (Yatvin, 1976). High achievers operate at a formal operational level earlier than their peers. They learn at a rate of 50 - 75% faster than the other students. Quantitative tests can identify and predict the success of students in future mathematics courses with relatively good validity. However, care must be taken when setting the cutoff scores for entrance into acceleration programs. Setting these criteria too high could eliminate students who are capable of being successful. Setting them too low, however, permits students to attempt a goal that is beyond their current reach and possibly harm their self-image and consequently their education (Reynolds, 1983).

If students do not have a sound academic skill foundation, established by experience with observing phenomena, communicating and formulating concepts, they are at a disadvantage. These students may be able to perform mechanical operations but have no understanding and no base upon which to develop further competence. The attitudes, fears, and self-image of the students who are pushed ahead need to be considered. Students who are accelerated and then do less well than they had been doing before the acceleration may begin to doubt their abilities and self worth (Yatvin, 1976).

It is crucial to recognize that the studies showing that the mathematically gifted students can learn mathematics well and much more quickly than the regular curriculum allows (Sowell, 1993) are referring to the top 3-5% of students, not just those who usually make A's (Prevost, 1992). Acceleration is often misused and may be better replaced with enriched or more in depth learning (Stanley, 1990).

An exhaustive study in all New Hampshire schools revealed that less than half of all accelerated students went on to take five years of high school mathematics. A similar study in Wisconsin showed the accelerated math program to have a retention rate which varied from 25 - 41%. Even some of those continuing in the fourth and fifth years who were among the best of the brightest when chosen for acceleration were no longer doing well (Prevost, 1988). The Bryan Independent School District showed a retention rate of only 43% and in the sixth year of the program faced a 21% dropout rate in the first year alone (Dockweiler, 1981).

In surveys, the most common reason students gave for dropping out of the program was that their math achievement was far below their achievement in other courses. This occurred despite the fact that they were among the highest achievers in sixth and seventh grades (Prevost, 1992).

The Piedmont study showed the lowest dropout rate, which was still 21%. Although there was not an actual assessment of motivation and interest, the students in Piedmont were required to attend a "0" period class at 7:00 a. m., thus eliminating some motivational problems. The Piedmont study did recommend that interest in mathematics be assessed in the future and used as part of the selection criteria (Reynolds, 1983).

The NCTM reports that the needs of the mathematically gifted and talented are not met by a program that only accelerates students through the standard program and allows them to terminate their study of mathematics before high school graduation. They recommend that the gifted and talented students would best be served by an enriched and expanded curriculum. Acceleration should be used only for the very few whose interests, attitudes, and participation reflect the ability to excel through the entire program (Prevost, 1988).

The SIMS and the NAEP report unflattering statistics about eighth graders' math achievement in the United States. The eighth graders of the United States have never achieved higher than the international median and sometimes scored at and below the 25 percentile. Scores in geometry and measurement were particularly disturbing. Overall achievement from 1964 to 1982 actually declined, with marked declines in arithmetic and geometry. Much of the decline was on comprehension and application items. Students showed a reasonable proficiency with computational skills, but the majority did not understand many of the basic concepts and were unable to apply them to even simple problem solving situations (McKnight, 1985).

Studies have shown that the pervasiveness of repetition in the math curriculum ceases abruptly with algebra. Here almost 90% of the material is new to the students. This shift is one of the weakest links in the math curriculum. To help with this transition from repetitive arithmetic to the all-new algebra, the curriculum in earlier grades must be adjusted. In particular, the seventh and eighth grade math programs must include more of the doing of mathematics reflecting abstracting, inventing, proving and applying. The NCTM's Curriculum and Evaluation Standards for School Mathematics (1987) proposes that the need for change is nowhere more acute than in grades five to eight. This report also pointed out that there is a low level of coverage of many topics. The overall picture was of a low intensity of dealing with each content area. This is a sharp contrast to other countries, especially Japan (McKnight, 1985; Prevost, 1992).

Most current acceleration programs are designed to serve the mathematically precocious students, the top 3-5%. Frequently they end up serving as many as 25-33% of eighth graders. These students are then frustrated by the new expectations. Programs in sixth and seventh grade have made little provision for the adjustment and students are shocked by their mediocre performance in an area in which they earlier excelled. Students have reflected positive attitudes about the importance of mathematics; however, they are generally neutral in their view of themselves as math learners (McKnight, 1985; Prevost, 1992).

The effect of student expectations on learning is well documented. A study relating student expectations to achievement in eighth grade mathematics showed a high correlation with achievement and with the expectations others held of them. Student expectations and self-image should be included in theory building along with aptitude (Smead, 1981).

In the SIMS, four typical eighth grade class types--remedial, typical, enriched and Algebra I--were examined by the use of pretests and post tests for algebra achievement. The enriched classes showed the largest gain, even greater than that of the accelerated Algebra I class (McKnight, 1985). This supports the idea that there are viable alternatives to the accelerated Algebra I programs and that they would benefit most students (Prevost, 1992).

Since the early 1950's special mathematics classes for the gifted students have been advocated. The eighth grade Algebra I programs have remained popular as a way to accelerate these students and enable them to take five years of college preparatory math in high school. These programs, although generally successful, have had various areas of difficulty. One consistent consequence, however, was a high rate of attrition. Suggested solutions have included: assessing student interest in math, creating special class times such as the "0 period" at 7:00 a.m., making major changes in the teaching of math in the primary and middle grades, assessing readiness for an accelerated program, and by defining, or redefining, selection criteria for entrance into the program. Each program encountering difficulties should be studied individually to assess areas of need and possible solutions that take into account the nature of the program and the population that it serves.

CHAPTER THREE

Methodology

The purpose of this study is to analyze the selection criteria used in Harrison County to place students in the accelerated mathematics program to determine whether the current criteria serve as good predictors of success in completing the program.

Population

Harrison County is nearly an all-white community with a population of 69,400 covering 417 square miles in north central West Virginia. The two largest communities have populations of 18,000 and 7,000. The remaining 44,000 residents live in rural areas or in communities of less than 2,500. While the total population has declined significantly over the past fifteen years, the proportion of the elderly has increased and the proportion of the school age population has decreased. The labor force unemployment has also increased significantly. The median income remains low, and approximately 17% are living below poverty level. The level of educational attainment, however, has continued to increase, with 71% high school graduates and 13.5% with a bachelor degree or higher.

Sample

The sample for the study will consist of program participants in the class of 1998 from each of the high schools in Harrison County. Although some of the descriptive statistics will use the entire sample, the correlational study may be further limited by the availability of student data.

Permission

The Harrison County School Board has granted permission to access student records in order to gather appropriate data for this study. This permission is conditional, requiring that all students remain anonymous; that a copy of the final paper be given to the Administrative Assistant, Department of Planning, Research and Evaluation; and that the paper be made available to any interested persons in the Harrison County school system. Further permission must be granted by the principal of each school from which data is collected.

Included are copies of the selection criteria, continuation requirements, and the agreement to be signed by each student upon entering the program.

Sources of Data

Identification of participants, the college preparatory math courses each has taken, and the students' grades in those courses will be acquired through the use of the West Virginia Education Information System (WVEIS). Test scores and grades used as selection criteria will be acquired from the individual files kept in the guidance office of each high school.

Data from the various schools will not be treated separately, but grouped to make one countywide study. This will be done to minimize the possible impact of varied teaching styles, socioeconomic-economic backgrounds, and school climates on the study results.

The information to be collected will include the seventh grade math grade average, seventh grade CTBS scores for the mathematics concepts and computation subtests, and the scores on the Iowa Algebra Aptitude Test. In addition, each student's grade average for each college preparatory math class will be obtained.

Analytical Procedures

A descriptive study of the data will be made first. This will include a table showing the percentages of participants who were successful in Algebra I (grade A or B), failed Algebra I, repeated Algebra I, and did not meet the requirements for advancement but advanced nevertheless. A second table will illustrate the percent of participants taking each successive course and the percent in each course receiving each grade level. Another table will reflect the percent of participants continuing through 2, 3, 4, or 5 college preparatory math classes, as well as the over all dropout rate and percent of students completing the program successfully (at least a B average). Also, for those students who meet the pre-algebra requirement, percentages will be determined for those who complete five years successfully, those who do not complete five years, and those who complete five years with less than a B average.

To test whether the selection criteria are valid predictors of success in the program, the nature of the variables must be considered. The predictor variables, the various test scores, are discrete and quantitative in nature and the outcome, or second variable, successful or not successful, is qualitative and a dichotomy. Therefore frequency graphs will first be created for each set of test scores for the successful participants and for those not successful. These graphs have the potential not only to indicate if a test was a good predictor of success, but also to suggest appropriate cut offs for these test scores.

In addition to graphing each of the predictor tests in this manner, a graph will also be created using the average of the two CTBS subtests. This information might be beneficial for a student who falls somewhat short of one requirement, but balances this with a higher score on the other.

The correlation between each set of pre-requisite test scores and the successfulness of the students will be examined by calculating the Pearson product moment correlation coefficient. In order to do this, each student's achievement in the program will be given a success score. This score will be determined by giving them one point for each college preparatory math course taken plus the ratio of their total grade points for the classes divided by the total possible grade points for the number of classes taken. For example, if a student took four college preparatory classes and received grades A, C, B and C, the success score would be $4 + [(4 + 2 + 3 + 2)/16]$, or 4.6875. Because success in the program is defined as completion of five years of college preparatory math class with a B average or better, a score representing success in the program would be 5.75 or higher.

These adjusted scores will also be used to create regression equations for each set of pre-requisite test scores, as well as a multiple regression equation using all pre-requisite scores.

Compilation and graphing will be aided by use of Microsoft Excel.

Research question 1: Does a student's score on the CTBS mathematics concepts subtest predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the CTBS mathematics concepts subtest.

H_1: There is a significant relationship between success in the AMP and the CTBS mathematics concepts subtest.

Research question 2: Does a student's score on the CTBS mathematics computation subtest predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the CTBS mathematics computation subtest.

H_2: There is a significant relationship between success in the AMP and the CTBS mathematics computation subtest.

Research question 3: Does the average of a student's scores on the CTBS computation and mathematics concepts subtests predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the average of the scores on the CTBS computation and mathematics concepts subtests.

H_3: There is a significant relationship between success in the AMP and the average of the scores on the CTBS computation and mathematics concepts subtests.

Research question 4: Does a student's score on the Iowa Algebra Aptitude Test predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and the Iowa Algebra Aptitude Test.

H_4: There is a significant relationship between success in the AMP and the Iowa Algebra Aptitude Test.

Research question 5: Does the student's grade in seventh grade pre-algebra predict success in the AMP?

H_0: There is no significant relationship between success in the AMP and final grade in seventh grade pre-algebra.

H_5: There is a significant relationship between success in the AMP and final grade in seventh grade pre-algebra.

CHAPTER FOUR

Results

The sample for this study consists of the 149 students of the class of 1998 who participated in the AMP in Harrison County. The students were identified by an eighth grade Algebra I grade on their permanent records. This selection method leaves out, unfortunately for analysis purposes, any student who might have been selected for the program but either chose to repeat pre-algebra or dropped out of Algebra I during their eighth year. There were no records of these two situations.

Of the 149 participants, 70% (105 students) were successful (maintaining grade A or B) in Algebra I. Of the 44 students who did not meet the requirements to continue, 12 students had grade D or F, and 25 students were permitted, none the less, to advance to geometry. Only 19 of the 44 unsuccessful students actually repeated Algebra I as Table 1 shows.

TABLE 1.
ALGEBRA I PERFORMANCE

	NO.	%
Participants	149	100
Successful (A or B)	**105**	**70**
Grade D or F	12	8
*Repeated Algebra I	25	17
Advanced without meeting requirement of a B- average	25	17
Did not meet advancement requirement	**44**	**30**
*Six students repeated Algebra I even though they met advancement requirements.		

The program's dropout rate for the first year, if the progress criteria had been adhered to, would have been 33%. As it was, only a 17% dropout rate is recorded. Although there were no dropouts after geometry, 13 more students left the AMP after Algebra II and 37 more left after Trigonometry. This brought the total dropout rate for the AMP up to 51% as detailed on Table 2.

TABLE 2.
DROPOUT STATISTICS

No. of participants	No. of dropouts	%
149 completed Algebra I	0	0
123 completed geometry	26	17*
123 completed Algebra II	0	0
110 completed trigonometry	13	9
73 completed calculus	37	25
Total dropout rate	76	51
First year dropout rate	26	17*
First year students who did not meet advancement requirement	44	30**

*Actual number would be higher, but no data was available on students who dropped Algebra I during the school year.

**Advancement requirement of a B average was not enforced.

Table 3 shows student achievement by course. Note that even in the basic college preparatory courses, Algebra, geometry, and Algebra II, there are 38 to 44 of the county's chosen students doing below B work. Of the 73 students who completed the 5-year program, 61 did so with a B average or better, 12 did not. Of the original 149 participants, 41% completed the AMP successfully.

TABLE 3.
ACHIEVEMENT BY COURSE

			A or B		C		D or F	
	No.	% of original participants	No.	% of those in AMP	No.	% of those in AMP	No.	% of those in AMP
Algebra I	149	100%	105	70%	32	21%	12	8%
Geometry	123	83%	85	69%	31	25%	7	7%
Algebra II	123	83%	85	69%	29	24%	9	9%
Trigonometry	110	74%	89	81%	17	15%	4	4%
Calculus	73	49%	60	82%	8	11%	5	7%

Pre-algebra grades were available for only 53 of the 149 students. Of the 89% who were successful in pre-algebra, 47% dropped out of the program and 45% completed the 5 years successfully. The six students who were not successful in pre-algebra were all permitted to advance to Algebra I in the eighth grade. None of these completed the 5-year program as indicated on Table 4.

TABLE 4.
PRE-ALGEBRA ACHIEVEMENT AND SUBSEQUENT ACHIEVEMENT

Successful Pre-Algebra Students	89%
Successful Pre-Algebra Students who dropped out of the AMP	47%
Successful Pre-Algebra Students who completed the AMP with less than a B-Average	8%
Successful Pre-Algebra Students who completed the AMP successfully	45%
Unsuccessful Pre-Algebra Students	11%
All unsuccessful students were permitted to advance. None completed 5 years	

It is of special note that research question 4, concerning the predictive value of the Iowa Algebra Aptitude Test, could not be examined. There was no record of any student's score on this test. Upon further inquiry, it was found that not only was the test not administered, but that neither the Harrison County Administrative Assistant, Department of Planning, Research and Evaluation, nor the County Mathematics Coordinator had a copy of the test. For each of the other four hypotheses Microsoft Excel was used to determine the Pearson correlation coefficient, a regression equation, the F-value and the observed t value.

As shown in Table 5 for the four sets of scores for which data were available, the Pearson correlation coefficient indicates a strong correlation at the .01 level of significance between each of the test scores and success in the AMP. The CTBS computation subtest showed the lowest, but still significant, correlation (.381), but when averaged with the CTBS concepts subtest showed the highest correlation (.487).

TABLE 5.
PEARSON CORRELATION FOR THE SELECTION CRITERIA

Hypothesis	Type of Score Examined	Pearson Correlation Coefficient
H_1	CTBS concepts	.476
H_2	CTBS computation	.381
H_3	Average of CTBS concepts and computation	.487
H_4	Iowa Algebra Aptitude Test	No data available
H_5	Pre-Algebra grades	.448

Figures 1 through 4 show scatter plots of the success scores for each of the CTBS subtests, for the average of these tests, and for the pre-algebra grades. All indicate that there is some degree of correlation. These same sets of data were used to create the regression equations examined in Table 6. Based on n = 115 and $p < .01$, the observed F-values and t-values were high enough to reject the null hypotheses for H_1, H_2 and H_3. In testing H_5, $n = 53$ and $p < .01$. Here also, the F and t values were high enough to reject the null hypothesis. Therefore, it can be concluded that the pre-algebra grade, the CTBS concepts and computation subtests scores, as well as the average of these two scores, all correlate to success in the AMP and might be used to predict success.

FIGURE 1.
Scatter Plot of Success Scores for CTBS Concepts Subtest Scores.

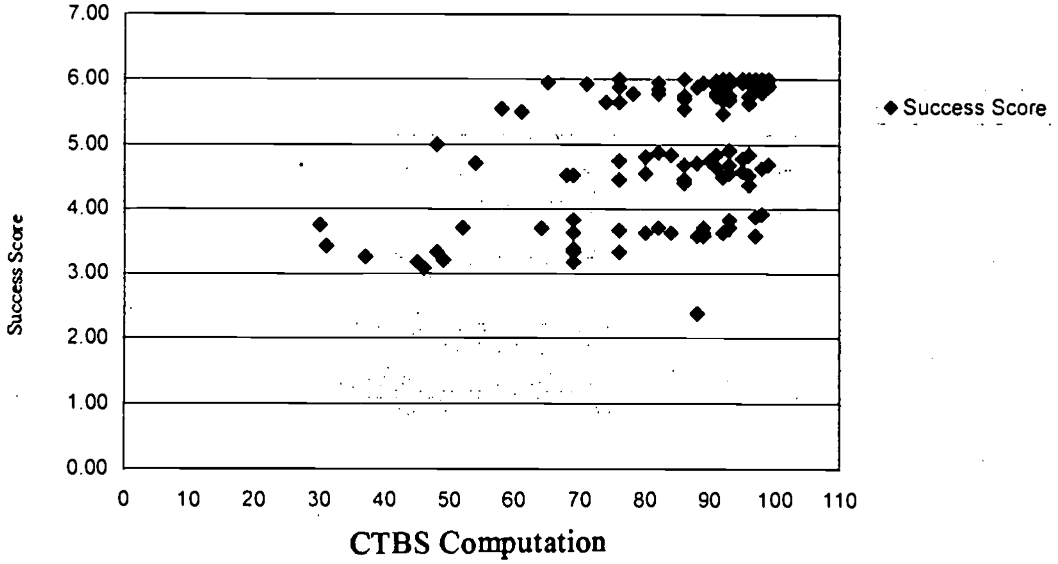


FIGURE 2.
Scatter Plot of Success Scores for CTBS Computation Subtest Scores.

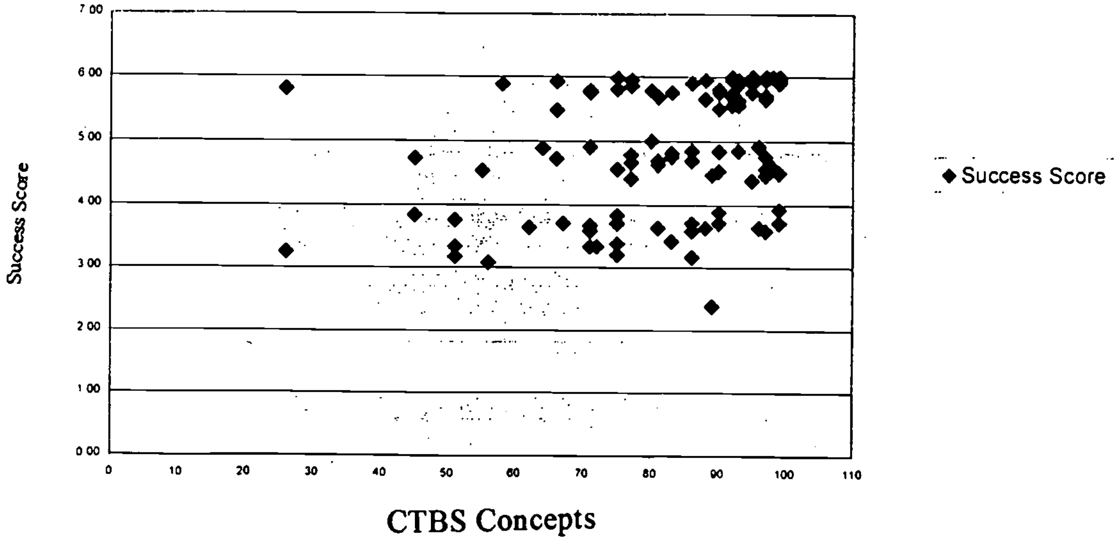


FIGURE 3.
Scatter Plot of Success Scores for the Average of CTBS Concepts and Computation Subtests Scores.

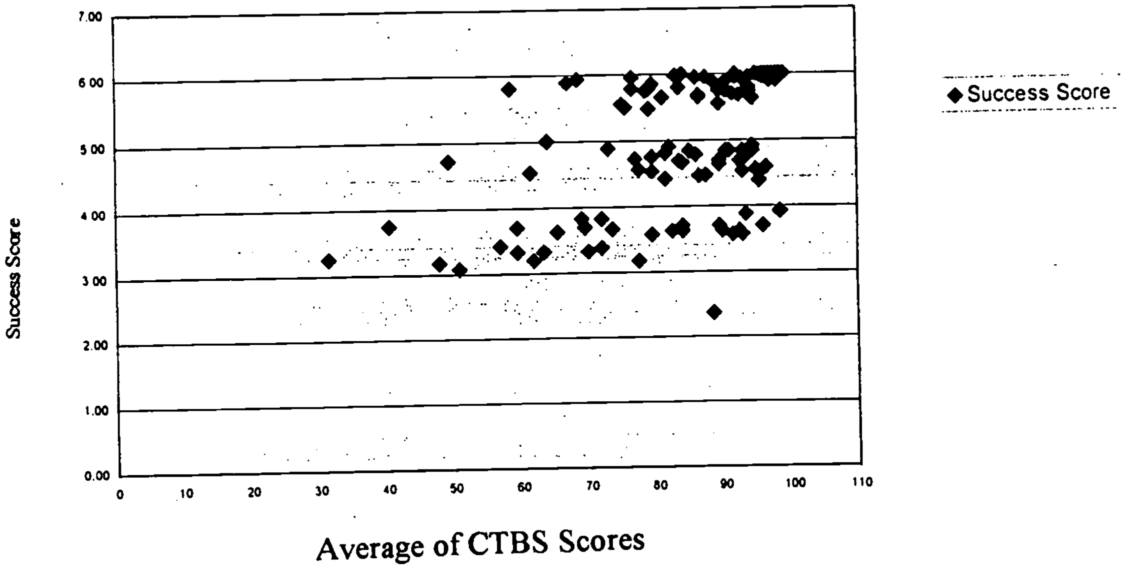


FIGURE 4.
Scatter Plot to Success Scores for Pre-algebra Course Grades.

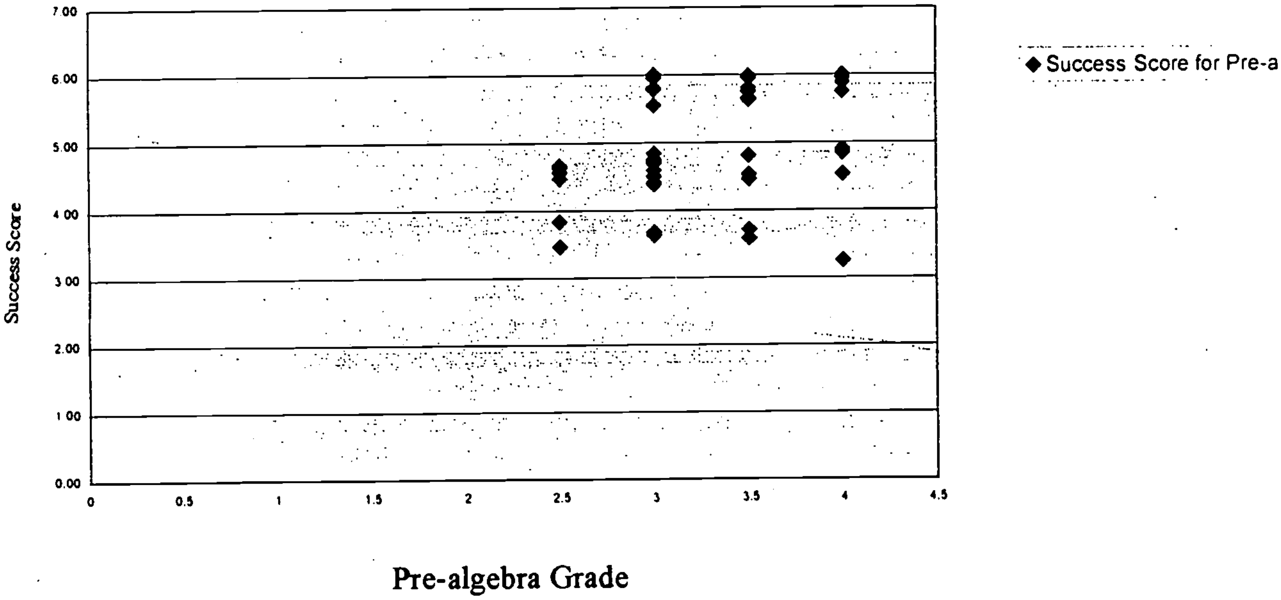


TABLE 6.
HYPOTHESES TEST RESULTS

Hypothesis	Score Examined	n	F	t
H_1	CTBS concepts* $y = .0299x + 2.418$	115	33.149	5.761
H_2	CTBS computation* $y = .0246x + 2.869$	115	19.164	4.393
H_3	Average of CTBS concepts and computation* $y = .0352x + 1.977$	115	35.199	5.931
H_5	Pre-Algebra grades** $y = .7242x + 2.5956$	53	11.350	3.369
*for $p < .01$; significant $F = 6.87$; critical $t = 2.362$				
**for $p < .01$; significant $F = 7.16$; critical $t = 1.299$				

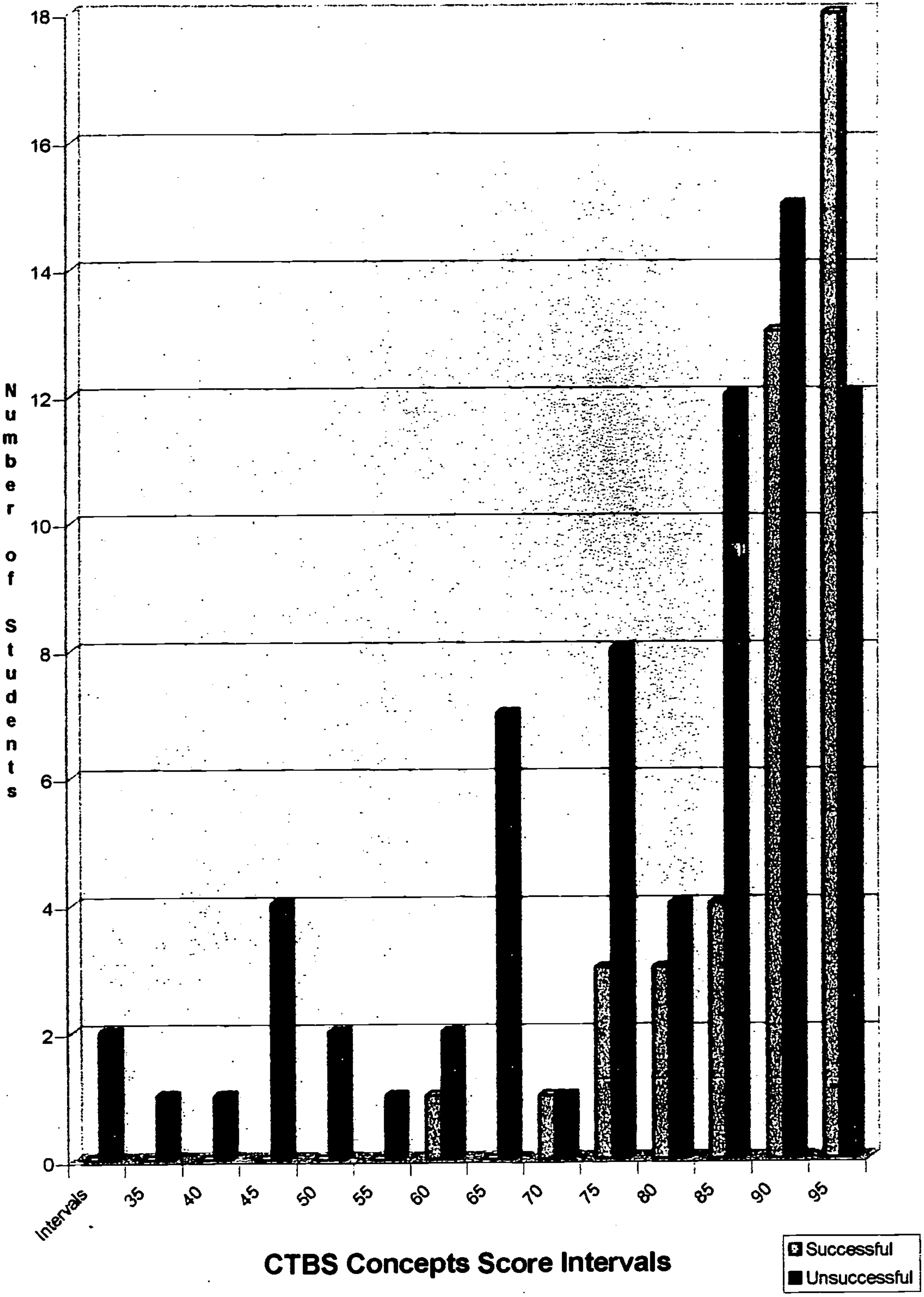
In addition, a stepwise regression analysis was made starting with a multiple regression equation for all three variables and eliminating the variable with the least significant correlation. For the stepwise regression analysis the sample was limited to 53, since there were only 53 students for whom the pre-algebra grades were available. The coefficient of determination, r^2, ranging from 0 to 1, is an indicator of how well the regression equation explains the relationship among the variables tested. The result as shown in Table 7 shows r^2 to vary from .381 to .543, with CTBS computation scores alone being the least significant and a combination of all three being the most significant. These numbers suggests that all three criteria and only two is so small, that the pre-algebra grade and the CTBS concepts score might be sufficient as predictors of success.

TABLE 7.
STEPWISE REGRESSION ANALYSIS OF SELECTION CRITERIA

Variables Tested	r^2
CTBS concepts, CTBS computation, Pre-Algebra	.5431
y = .6959 (Pre-Alg.) + .001389 (CTBS comp.) + .02466 (CTBS concepts) + .395	
CTBS concepts, Pre-Algebra	.5427
y = .02569 (CTBS concepts) + .7038 (Pre-Alg.) + .3969	
Pre-Algebra	.4266
y = .724 (Pre-Alg.) + 2.5956	
CTBS concepts	.4762
y = .0268 (CTBS concepts) + 2.680	
CTBS computation	.3808
y = .01347 (computation) + 3.89	

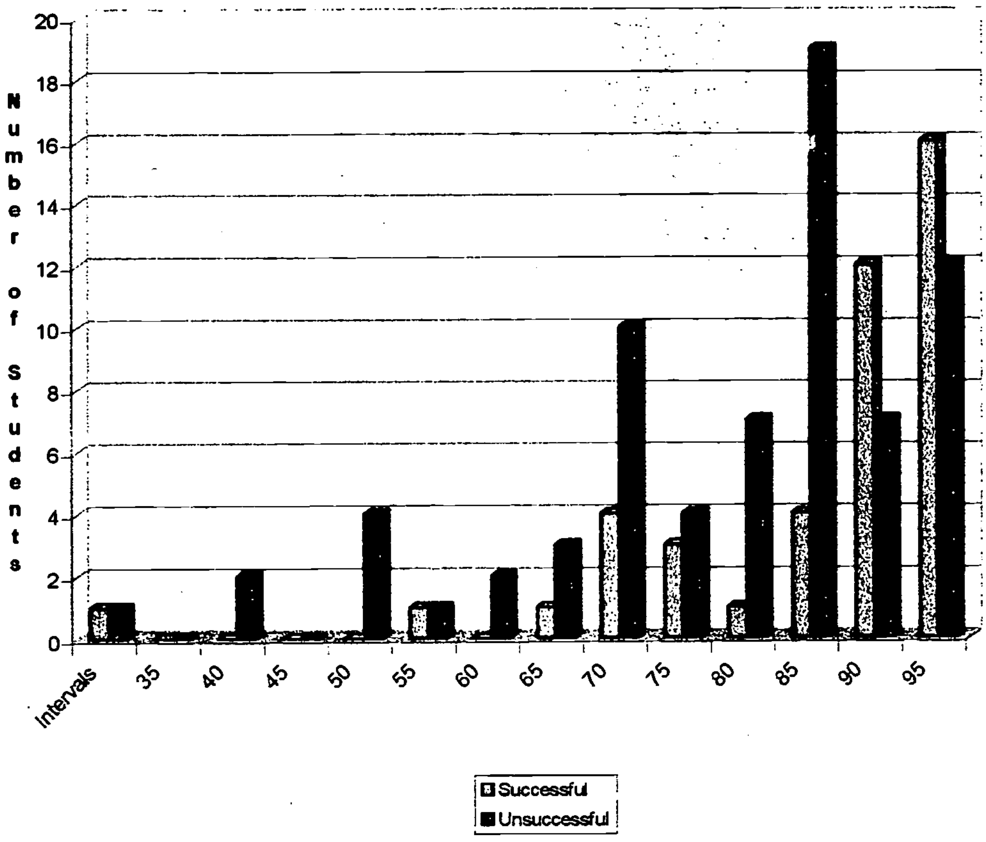
Although the research concludes that the criteria are relevant predictors of success, another area of concern arises. That is whether the criteria are set at appropriate levels. An examination of frequency graphs may help to suggest suitable cutoff levels. Of the 115 students for which CTBS concepts scores were available, 43 were successful in the AMP. The frequency graph (Figure 5) shows that, although 31 of the 43 successful students had CTBS concepts scores higher than the 90th percentile, successful students out-numbered the unsuccessful students only for those with scores above 95. For students with scores below 90, there were 45 unsuccessful students and only 12 successful students. Considering the county criterion of 75 or higher on the CTBS concepts score, one sees that this led to a group of 41 successful and 51 unsuccessful students. Since previously discussed data showed a strong correlation between CTBS concepts scores and success in the program, these figures suggest that the cutoff score may be set too low. Of the 23 students who were permitted to enter the program without meeting this criteria, only 2 were successful.

FIGURE 5.
Comparison of the Frequency of Successful and Unsuccessful Students for Intervals of CTBS Concepts Scores



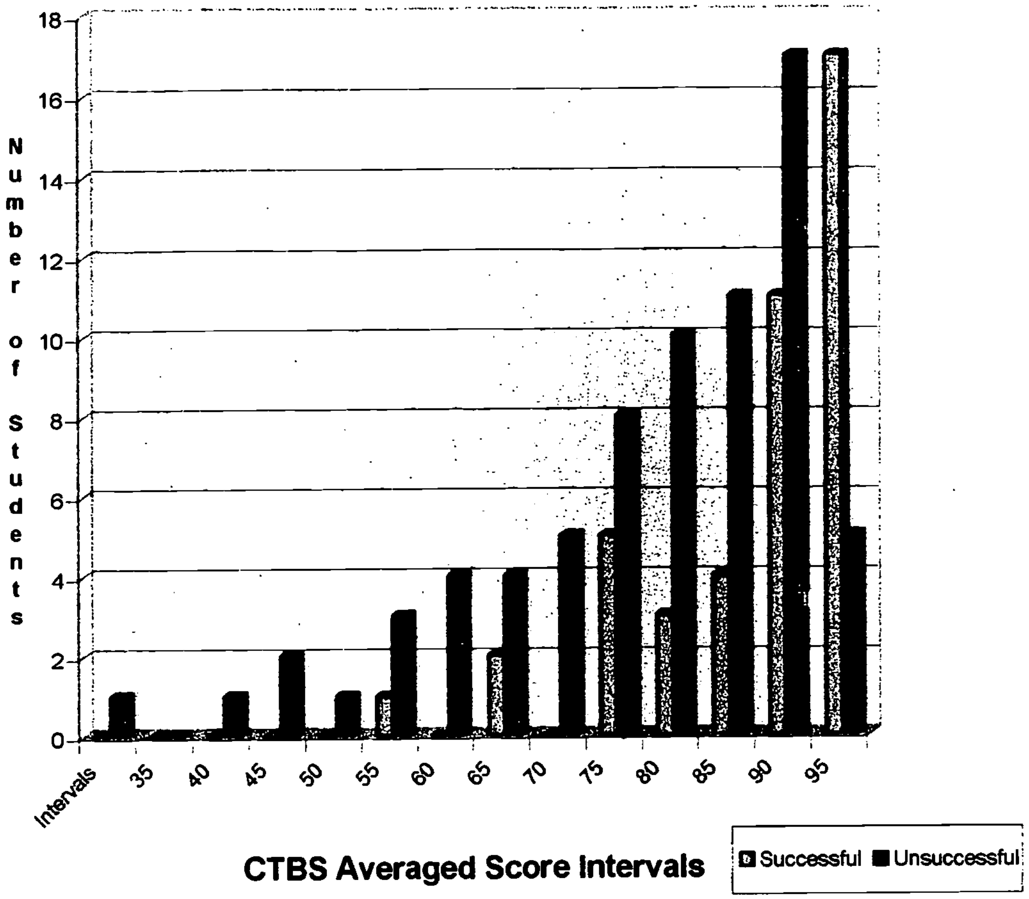
A similar discussion of the CTBS computation score can be made. Of those meeting the criterion of scoring at or above the 80th percentile, 33 were successful and 45 were not. As the frequency graph (Figure 6) shows, only for those with scores above 90 did successful students out-number the unsuccessful. Figure 7 shows comparable figures using the average of the two CTBS scores. Successful students out-number the unsuccessful only above the 95th percentile.

FIGURE 6.
Comparison of the Frequency of Successful and Unsuccessful Students for Intervals of CTBS Computation Scores



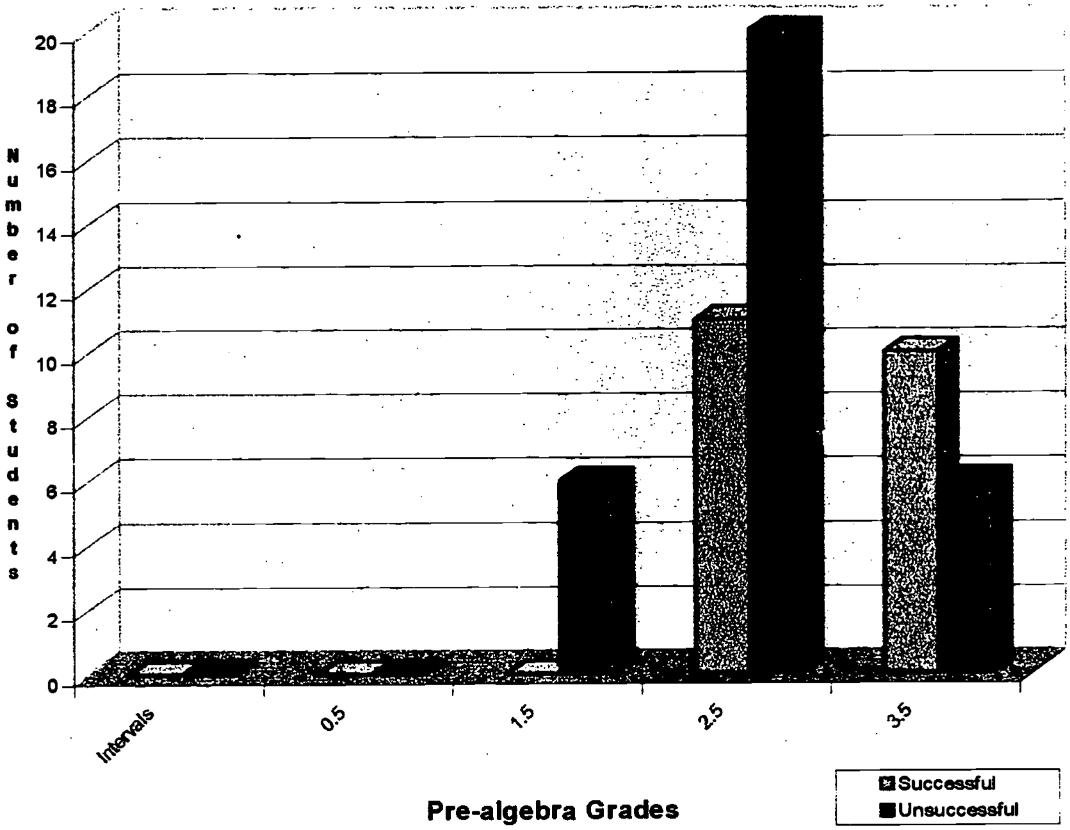
CTBS Computation Score Intervals

FIGURE 7.
Comparison of the Frequency of the Successful and Unsuccessful Students for Intervals of the Average of the CTBS Concepts and Computation Scores



Pre-algebra data (Figure 8) shows that for those meeting the criterion with a B average there were almost twice as many unsuccessful students as there were successful. Only for those with an A average did the successful students outnumber the unsuccessful.

FIGURE 8.
Comparison of the Frequency of Successful and Unsuccesssful Students for Each Grade in Pre-algebra



CHAPTER FIVE

Discussion

Do the current criteria for entering Algebra I in the eighth grade serve as good predictors of success in completing the Accelerated Mathematics Program in Harrison County? Yes.

Several studies have examined the selection criteria and results of advanced mathematics programs across the nation, and a variety of problems were uncovered. However, it is suggested by Barbara Flexer (1984) that, in order to reflect the nature of the particular program and the nature of the population, such studies must be done on a local basis. Therefore, this study was conducted in Harrison County, West Virginia, using data from the AMP participants from the class of 1998. Its purpose, to determine if the criteria used are effective in identifying students who will succeed in the AMP, was accomplished.

The students' scores on each of the criteria were compared with their level of success. In each case, the correlation coefficient indicated a strong correlation (Table 5). The observed F-values and t-values obtained from regression equations (Table 6) were all high enough to reject the null hypotheses. Therefore, the conclusion of this study indicates the criteria currently used are all relevant predictors of success. These results, combined with the 51% dropout rate, however, suggest a need for further research to examine the cutoffs for each criterion.

It is important to consider for whom the Accelerated Math Program was created. Publicity and parent pride might be served by overplacing students in Algebra I in the eighth grade, but the students are not helped by this. Accelerated programs are designed to serve the mathematically gifted and talented, the top 3 to 5%. Frequently, as in Harrison County, the program includes as many as 25 to 33% of eighth graders. This invites problems.

Students are often frustrated by the new expectations of a class that has little repetition of past topics. They are then shocked by their mediocre performance in an area in which they earlier excelled. Overplaced students often fall behind and have difficulty making up lost ground. When pushed too far, too fast, students develop self-doubt rather than self-confidence. Joanne Yatvin (1976) states that there is ample evidence that children who are accelerated do not do any better in the long run than those who are not. Educators are often told to keep in mind that success breeds success. Many of those who are accelerated would be better served by another year of success in a math class that could help prepare them for algebra by broadening and deepening their understanding of math concepts.

In Harrison County students are often placed in the AMP without meeting the approved selection criteria. For the class of 1998, at least 23 students with average and below average CTBS scores were allowed to enter the program. One student had scored at the 26th percentile on the CTBS computation subtest and at the 37th on concepts. Cutoffs are 80th and 75th percentiles, respectively.

Even good computation skills, however, are not sufficient. Students must be ready to deal with the abstract nature of algebra. Barbara Flexer's study found an algebra prognosis test to be the best overall predictor of success. A team of teachers and administrators in Harrison County apparently believed this was important also and included a 65th percentile score on the Iowa Algebra Aptitude test as a part of the selection criteria. However, not only was there no record of any student having taken the test, but no one at the county office could find a copy of one. Some type of algebra readiness test could be of significant value in the selection process and needs to be utilized.

Harrison County might also do well to assess interest in mathematics. Several studies show this to be important in reducing the dropout rate of the program. They find that the overall dropout rate is about 50%. The main reason cited by the students was their math achievement (grades) was far below their achievement in other courses, despite the fact that they were among the highest achievers in earlier grades. Donald Chambers (1987) was both pleased and dismayed with his findings in a Wisconsin study. He writes: "The good news is that the retention rate has increased from 25% to 41% over the last six years. The bad news is that only four out of ten students identified as our best and brightest in the seventh grade are still among our best and brightest four years later." The NCTM also states that accelerated math programs are recommended only for those whose interests, attitudes and participation clearly reflect the ability and desire to excel throughout the program.

The fact that Harrison County places too many students in the AMP is highlighted by noting the percent of students other areas place in their programs. New Hampshire places about 10% of the eighth graders in Algebra I, North Carolina places about 12%, and although it varies by socioeconomic areas, the entire Northeast Region averages

8.4%. The nationwide SMPY program places 1 to 2% in their programs. In contrast, Harrison County places about 30% in eighth grade Algebra I. This overplacement goes hand in hand with the 51% dropout rate. A need for correction exists.

All currently used criteria have been shown to be valuable in assessing the students. Adherence to current criteria would have eliminated several failures. However, the frequency tables suggest that the standards should be raised significantly. An examination of the CTBS concepts scores, computation scores and the average of the two show that only for those students with scores from 90 to 99 did the successes out-number the failures. A more stringent cut off at the 90th percentile would have saved 74% of the dropouts and affected only 9 students who were successful through calculus. These 9 students would still have had the opportunity to accelerate by taking both Algebra II and geometry in their sophomore year, a rather common practice in Harrison County. With the current block scheduling in some schools, this option is even easier, since the two courses may be taken in consecutive semesters rather than simultaneously.

The NCTM says that the needs of the mathematically talented cannot be met by only accelerating students through the standard curriculum or programs that allow them to terminate their study of math before graduation. They need enriched and expanded programs that emphasize higher order thinking skills and nontraditional topics. There is much to be said for viable alternatives to the AMP. Usiskin, who is in favor of all students taking Algebra I in the eighth grade, says that because the enriched eighth grade course includes a significant amount of algebra, one might as well just teach Algebra I. But since all students in Harrison County need to pass Algebra I to graduate, they will be better prepared to handle a full Algebra I course after taking an enriched and expanded eighth grade course. This seems to be a useful and helpful alternative to the overplacement of so many eighth graders.

This study indicates that the Harrison County accelerated math program has been suffering from poor selection and high attrition. However, it can be salvaged. A team of math teachers from the middle and high schools should be created to further study the situation. Adjusting the cut off scores for the CTBS subtests, including an algebra prognosis test, assessing interest, adhering to the county policy, and providing an alternative of math enrichment in the eighth grade are all recommendations that should be seriously considered in Harrison County.

Appendices

APPENDICES

Appendix A

Student and Parent Letter of Agreement

ACCELERATED MATH PROGRAMS

COURSE OF STUDIES--Accelerated 6th Grade through AP Calculus AB

My child and I understand the accelerated mathematics program of Harrison County consists of seven courses over a seven-year period beginning in grade six and finishing in grade twelve. We understand that by allowing my child to enter the accelerated math program, he/she is making a commitment to take advanced math classes each year of his education through graduation.

We also understand that academic excellence is demanded during participation in this program and that failure to make grades of B or better or failure to meet county established criteria at identified level will mean his/her withdrawal from the accelerated program and placement in the regular mathematics program.

My child,______________________________, does have my support to enroll in the Accelerated Mathematics Program and to continue in the Accelerated Mathematics Program throughout his educational experience in Harrison County Schools.

Signature of Parents____________________________________

I, ____________________________, am willing to commit to completing the Accelerated Mathematics Program at all levels through and including my senior year.

Signature of Student____________________________

Source: Bridgeport Middle School, Harrison County.

Appendix B

Student Data

Student number	CTBS Concepts	CTBS Comp	Ave CTBS	Pre-algebra	Algebra I	Geometry	Algebra II	Trigo-nometry	Calculus	Success Score
1	45	51	48.00		0.50	0.00	1.50			3.17
2	91	26	58.50	3.00	3.50	4.00	3.00	2.50	3.00	5.80
3	76	83	79.50	3.00	3.00	3.00	3.00	3.00		4.75
4	93	45	69.00	2.50	4.00	3.00	3.00			3.83
5	93	96	94.50	4.00	4.00	4.00	2.50	4.00		4.91
6	89	97	93.00	3.50	3.00	2.00	2.00			3.58
7	98	90	94.00	3.50	3.50	4.00	2.50	3.00	3.00	5.80
8	96	90	93.00	4.00	4.00	3.00	3.50	3.00		4.84
9	91	77	84.00	2.50	3.00	2.50	3.00	2.00		4.66
10	80	83	81.50	3.50	3.50	4.00	2.50	3.00		4.81
11	95	77	86.00	3.50	4.00	4.00	3.00	4.00	4.00	5.95
12	91	75	83.00	3.50	4.00	4.00	3.50	4.00	4.00	5.98
13	76	71	73.50	3.00	3.00	2.50	2.50			3.67
14	88	66	77.00	3.00	3.50	3.50	2.50	2.00		4.72
15	68	55	61.50	3.50	3.00	2.00	2.00	1.50		4.53
16	91	90	90.50	3.00	3.50	3.50	3.00	3.50		4.84
17	96	92	94.00		3.50	3.00	3.00	2.00	3.00	5.73
18	86	81	83.50		3.00	2.50	3.00	2.50		4.69
19	54	45	49.50		3.00	3.00	2.50	3.00		4.72
20	97	90	93.50		3.00	4.00	3.50			3.88
21	95	77	86.00		3.00	2.50	3.50	3.50		4.78
22	93	93	93.00		4.00	3.50	3.50	3.50	4.00	5.93
23	82	77	79.50		3.50	2.50	3.50	3.50	4.00	5.85
24	48	72	59.50		1.00	2.00	1.00			3.33
25	82	71	76.50		3.50	2.00	3.50	3.00	3.50	5.78
26	93	92	92.50		3.00	2.00	2.50	3.00	3.00	5.68
27	96	83	89.50		3.00	3.00	2.00	4.00	3.00	5.75
28	93	71	82.00		4.00	3.00	4.00	4.00		4.90
29	98	99	98.50		4.00	3.00	4.00			3.92
30	69	62	65.50		2.50	2.50	2.50			3.63
31	91	86	88.50		4.00	2.50	4.00	4.00	3.50	5.90
32	93	95	94.00		2.00	3.00	3.50	3.00	3.50	5.75
33	99	86	92.50		3.00	2.00	3.00	3.00		4.69
34	93	95	94.00		3.00	2.50	3.00	3.50	3.00	5.75
35	82	86	84.00		2.50	3.00	3.00			3.71
36	97	99	98.00		4.00	3.00	3.50	3.50	4.00	5.90
37	96	95	95.50		4.00	4.00	3.50	4.00	4.00	5.98
38	92	88	90.00		3.00	3.00	1.50			3.63
39	92	66	79.00		2.00	1.50	1.50	2.00	2.50	5.48
40	90	97	93.50		3.00	2.50	3.00	3.50		4.75
41	49	75	62.00		0.50	0.50	0.00			3.20
42	99	97	98.00		4.00	4.00	4.00	4.00	4.00	6.00
43	65	88	76.50		4.00	3.00	4.00	4.00	4.00	5.95
44	76	97	86.50		3.00	2.50	2.50	2.50	2.50	5.65
45	64	75	69.50		2.50	4.00	2.00			3.70
46	48	80	64.00		4.00	4.00	4.00	4.00		5.00
47	99	95	97.00		3.00	3.50	3.50	4.00	4.00	5.90
48	76	58	67.00		4.00	3.00	3.00	3.50	4.00	5.88

Student number	CTBS Concepts	CTBS Comp	Ave CTBS	Pre-algebra	Algebra I	Geometry	Algebra II	Trigo-nometry	Calculus	Success Score
49	84	86	85.00		4.00	3.00	3.50	3.00		4.84
50	97	86	91.50		2.00	3.50	1.50			3.58
51	82	64	73.00	4.00	2.00	4.00	4.00	4.00		4.88
52	37	26	31.50	4.00	1.00	2.00	0.00			3.25
53	93	86	89.50	3.00	2.50	3.50	3.00	2.00		4.69
54	96	92	94.00	3.00	3.00	4.00	4.00	4.00	4.00	5.95
55	30	51	40.50		2.00	4.00	4.00			3.75
56	96	93	94.50	4.00	4.00	3.50	3.00	3.00		4.84
57	86	97	91.50		4.00	3.50	1.50	4.00	1.00	5.70
58	96	97	96.50		4.00	4.00	3.50	4.00	4.00	5.95
59	99	98	98.50	4.00	4.00	4.00	4.00	4.00	4.00	6.00
60	98	99	98.50	3.50	3.50	4.00	4.00	4.00	4.00	5.95
61	99	99	99.00	4.00	4.00	4.00	4.00	4.00	4.00	6.00
62	88	89	88.50	2.50	1.00	2.00				2.38
63	86	71	78.50	3.50	3.00	3.50	2.50	3.00	3.00	5.75
64	86	89	87.50	2.50	2.00	2.50	3.00	0.00		4.47
65	82	93	87.50	3.50	3.50	4.00	4.00	4.00	4.00	5.95
66	95	95	95.00		4.00	4.00	4.00	4.00	4.00	6.00
67	98	99	98.50	4.00	3.50	4.00	4.00	4.00	4.00	5.95
68	96	95	95.50	3.00	2.50	2.50	2.00	0.00		4.38
69	92	75	83.50		2.50	3.00	3.50	4.00	3.00	5.80
70	92	92	92.00		4.00	4.00	4.00	4.00	4.00	6.00
71	96	86	91.00		3.50	3.00	3.00	4.00		4.84
72	98	81	89.50	2.50	3.50	3.00	2.50	1.00		4.63
73	93	99	96.00	4.00	4.00	4.00	4.00	4.00	4.00	6.00
74	99	98	98.50		4.00	4.00	4.00	4.00	4.00	6.00
75	86	98	92.00	4.00	4.00	4.00	4.00	4.00	4.00	6.00
76	98	99	98.50	4.00	4.00	4.00	4.00	4.00	4.00	6.00
77	96	90	93.00	4.00	0.50	3.00	2.00	3.00		4.53
78	91	90	90.50	4.00	4.00	3.50	3.50	3.00	1.00	5.75
79	76	97	86.50	3.50	2.50	1.50	1.50			4.46
80	89	90	89.50		2.00	3.50	3.00			3.71
81	99	99	99.00	3.00	4.00	4.00	4.00	4.00	4.00	6.00
82	88	93	90.50	4.00	3.00	3.00	3.50	4.00	4.00	5.88
83	76	51	63.50		1.00	2.00	1.00			3.33
84	69	75	72.00		1.50	1.00	2.00			3.38
85	95	98	96.50	3.00	2.50	2.00	2.00	3.00		4.59
86	69	90	79.50		2.00	1.50	3.00	2.00		4.53
87	86	93	89.50	3.50	1.50	2.50	3.00	3.00	1.00	5.55
88	76	92	84.00		4.00	4.00	4.00	4.00	4.00	6.00
89	71	66	68.50		2.50	4.00	4.00	4.00	4.00	5.93
90	74	88	81.00	3.50	3.00	2.50	2.50	2.00	3.00	5.65
91	92	99	95.50	3.00	2.00	2.00	2.00	2.00		4.50
92	46	56	51.00		1.00	0.00	0.00			3.08
93	80	75	77.50		1.50	2.50	3.00		2.00	4.56
94	69	86	77.50		2.00	0.00	0.00			3.17
95	96	99	97.50	4.00	4.00	4.00	4.00	4.00	4.00	6.00
96	52	67	59.50		2.50	3.00	3.00			3.71
97	97	97	97.00		4.00	4.00	4.00	4.00	4.00	6.00
98	80	88	84.00	3.00	2.00	3.00	2.50			3.63
99	61	90	75.50		2.00	2.00	2.00	2.00	2.00	5.50
100	93	97	95.00	2.50	2.00	2.50	2.50	2.00		4.56
101	89	96	92.50	3.00	2.50	2.50	2.50			3.63

Student number	CTBS Concepts	CTBS Comp	Ave CTBS	Pre-algebra	Algebra I	Geometry	Algebra II	Trigo-nometry	Calculus	Success Score
102	86	77	81.50	3.00	2.50	1.50	1.50	1.00		4.41
103	96	97	96.50	4.00	4.00	4.00	4.00	4.00	4.00	6.00
104	69	71	70.00		2.00	2.00	0.00			3.33
105	96	93	94.50	3.50	3.00	2.50	1.00	3.00	3.00	5.63
106	95	97	96.00		4.00	3.50	4.00	4.00	4.00	5.95
107	31	83	57.00		1.00	2.00	2.00			3.42
108	78	80	79.00	3.00	3.00	3.50	3.00	3.00	3.00	5.78
109	92	81	86.50		2.50	3.00	2.00	3.00	3.00	5.68
110	58	92	75.00	3.00	3.50	2.00	2.50	3.00	0.00	5.55
111	89	95	92.00	3.50	3.50	4.00	4.00	4.00	4.00	5.95
112	93	99	96.00	3.50	2.50	2.00	4.00			3.71
113	88	71	79.50		2.50	2.00	2.50			3.58
114	84	81	82.50		3.00	2.50	2.00			3.63
115	69	75	72.00		3.00	3.00	4.00			3.83
116				4.00	2.00	3.00	3.00			4.75
117				2.00	2.00	1.50				3.46
118				2.50	2.00	3.00	2.50			4.63
119				4.00	3.00	3.00	2.50	2.00		5.73
120				3.50	4.00	4.00	4.00	4.00		5.98
121				4.00	3.50	3.50	4.00			4.81
122				4.00	4.00	4.00	4.00	4.00		6.00
123				4.00	3.50	3.50	3.00	3.00		5.85
124				3.00	2.00	3.00	3.00	2.00		5.65
125				3.00	2.00	4.00	2.50	3.50		5.75
126				4.00	3.50	3.00	3.00	2.00		5.78
127				3.00	1.50	0.50				3.42
128				4.00	3.50	3.50	4.00	4.00		5.95
129				3.00		2.00	2.00	1.00		4.50
130				4.00	4.00	3.50	4.00	4.00		5.98
131				4.00	4.00	4.00	4.00	4.00		6.00
132				4.00	4.00	4.00	4.00			5.00
133				4.00	3.50	2.50	3.00	2.00		5.75
134				3.50	3.50	2.50	4.00			4.84
135				3.00	3.50	4.00	2.00	2.00		5.73
136				3.50	4.00	4.00	4.00	4.00		5.95
137				3.50	2.50	2.50	4.00	4.00		5.83
138				4.00	4.00	4.00	4.00	2.00		5.80
139				4.00	4.00	4.00	4.00	4.00		6.00
140				3.50	3.00	2.50	3.00			4.75
141				4.00	4.00	4.00	4.00	4.00		6.00
142				4.00	4.00	4.00	4.00			5.00
143				4.00	4.00	4.00	4.00	4.00		6.00
144				3.50	3.00	3.00	4.00			4.84
145				4.00	4.00	4.00	4.00	4.00		6.00
146				3.00	3.50	4.00	4.00			4.91
147				3.00	4.00	3.50	3.00			4.84
148				4.00	4.00	4.00	4.00	4.00		6.00
149				2.50	4.00	4.00	4.00	4.00		5.93

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